Synthesis report of legal, policy and science approaches within the frame of disaster risk reduction and CCA: The UK National Perspectives

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1 Introduction

1.1 The United Kingdom

1.1.1 The Geographic Context

The United Kingdom is an island country located off the north-western coast of mainland Europe. The United Kingdom comprises the whole of the island of Great Britain which contains England, Wales and Scotland, as well as the northern portion of the island of Ireland. England, occupying most of southern Great Britain, includes the Isles of Scilly off the southwest coast and the Isle of Wight off the southern coast. Scotland, occupying northern Great Britain, includes the Orkney and Shetland islands off the northern coast and the Hebrides off the north-western coast. Wales lies west of England and includes the island of Anglesey to the northwest. Apart from the land border with the Irish Republic, the United Kingdom is surrounded by sea. To the south of England, and between the United Kingdom and France, is the English Channel. The North Sea lies to the east. To the west of Wales and northern England and to the southeast of Northern Ireland, the Irish Sea separates Great Britain from Ireland, while southwestern England, the north-western coast of Northern Ireland, and western Scotland face the Atlantic Ocean. At its widest, the United Kingdom is 300 miles (500 km) across. From the northern tip of Scotland to the southern coast of England, it is about 600 miles long (1,000 km). No part is more than 75 miles (120 km) from the sea. The capital, London, is situated on the tidal River Thames in south-eastern England (Encyclopædia Britannica, 2017).

Figure 1- Map of the United Kingdom, source-Project Britain.com (2013)

1.1.2 Disaster Profile-United Kingdom

The history of different types of disasters in the UK includes a wide variety of incidents. According to EM-DAT (2015) during the period of 1990 to 2014, the most significant disaster events are floods and storms in terms of the frequency. In terms of mortality, 77.4% mortalities are reported due to extreme temperature and the least number of mortalities are recorded due to flood. However, as per the economic losses, floods are the most significant disaster which accounts for 63.1% of economic losses. Figure 2 describes the overall disaster losses (frequency, mortality, economic losses) during the period of 1990-2014.

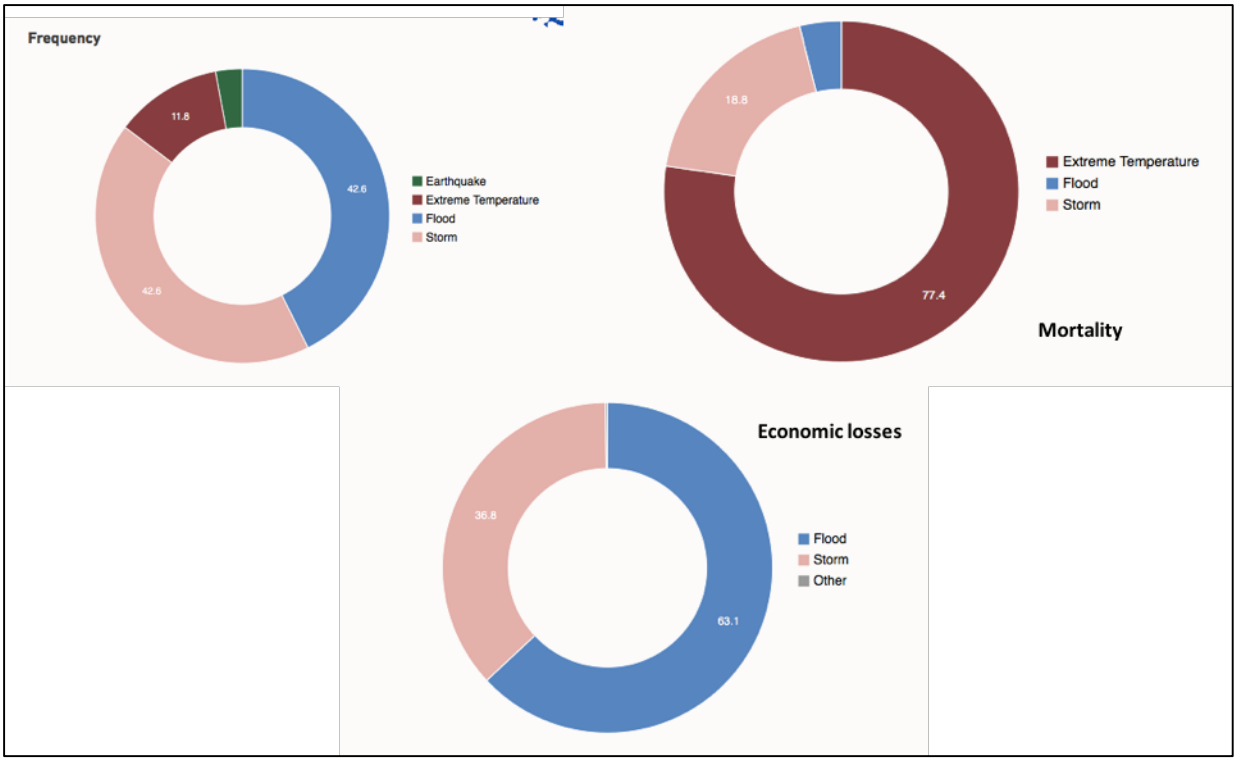

Figure 2-Disaster losses during 1990-2014, Source-EM-DAT (2015)

The most recent major disaster event experienced was the flood of December 2015 which mostly affected northern England. It was recorded that around 17,500 properties were flooded during this period (Spencer et al., 2016).

Figure 3-Rescue teams move through flood waters that inundated homes on the Huntington Road, York, during December 2015 floods. Source- (BBC, 2015)

Further, the coastline regions are usually affected by sea surges, high tides and gale force winds with severe storms and winds which can affect most of the country for at least six hours at a time. Most inland areas and regions experience storms with speeds of 55 mph and gusts which exceed 85 mph. In spite of relatively small impact, heat waves and droughts are also characteristic challenges for the UK. The impact of global warming also causes indirect effects on human health and increases the possibility of some natural disasters such as floods, rising of sea levels and so forth. Due to severe heat, the UK Government takes serious steps to prevent the elderly, young and other vulnerable population casualties through public awareness and education (Kapucu, 2009).

As can be seen, the UK is vulnerable to many natural events. Global warming, magnitude, frequency of extreme weather events and climate change scenarios have severe effects on agricultural prosperity. Severe wind storms, late spring frosts and weather conditions all have a direct impact on crop production. Being an island country affected by global climate change, the UK is a target of and destination point for severe storms and winds which cause serious damage to property. Severe windstorms can result in direct and indirect damage to buildings, vehicles, infrastructure, businesses and human life (Kapucu, 2009).

1.1.3 Disaster Management Structure

Institutions relevant for disaster management, their policies and legal backgrounds, will be discussed in Section 2, therefore, in this section, the aim is to produce a summary of the disaster management structure of the United Kingdom.

In the United Kingdom, the disaster management structure is established by an act of the United Kingdom Parliament that establishes a coherent framework for emergency planning and response, ranging from local to national level. The act is called the Civil Contingencies Act, 2004. The Civil Contingencies Secretariat is the national platform for disaster management. The Civil Contingencies Secretariat (CCS) sits within the Cabinet Office at the heart of central government. It works in partnership with government departments, the devolved administrations (Scotland, Wales & Northern Ireland) and key stakeholders, to enhance the UK's ability to prepare for, respond to and recover from emergencies. The CCS has specific objectives ranging from disaster response to building greater resilience for the future.

The overall structure of disaster management has generally remained with Central Government, fulfilling the role of co-ordinator and providing guidance. The structure of emergency management in the UK is decentralized. Most emergencies and incidents, based on scale or complexity, are handled at local level, with no involvement of Central Government. Local agencies are always the first responders and the ones who carry the burden of emergency management. In most cases, the police are considered one of the leading responders in local disasters (Secretariat Civil Contingencies, 2009).

The Climate Change Act (CCA) is the principal legislative background in dealing with climate change in the UK. The Climate Change Act produces a legislative background for both climate change adaptation and climate change mitigation. However, prior to the introduction of the Climate Change Act in 2008, there were other acts, bills and efforts initiated in the UK, focusing on climate change mitigation. Section 2.2 explains the Climate Change Act in detail.

2 Brief Description on existing Legal/Policies and Science Approaches

This section provides a brief description of the existing legal/policy and science approaches related to CCA and DRR in the context of the United Kingdom. A critical argument on the missing links, gaps and challenges is provided in Section 4.

2.1 Legal/Policy and Science Approaches in relation to DRR

2.1.1 Legal/Policy Approaches in Relation to DRR

2.1.1.1 Civil Contingencies Secretariat and Civil Contingencies Act, 2004

UNISDR (2013) explains the establishment of the Civil Contingencies Secretariat. Accordingly, it was established in July 2001 after serious flooding, the Fuel Crisis in 2000 and the Foot-and-Mouth Disease outbreak in 2001, exposed deficiencies in the UK's civil protection arrangements. Since then, the CCS has worked to improve the UK's preparedness for, and response to, emergencies.

The Civil Contingencies Secretariat (CCS) sits within the Cabinet Office at the heart of Central Government. It works in partnership with government departments, the devolved administrations (Scotland, Wales & Northern Ireland) and key stakeholders to enhance the UK's ability to prepare for, respond to and recover from emergencies.

The CCS has specific objectives which range from emergency response to building greater resilience for the future. The CCS's specific objectives are:

1. Spotting trouble, assessing its nature and providing warning:

Emergencies in the early years of this century showed that the UK was missing the warning signs, failing to prevent emergencies and being caught unaware when they occurred. The CCS now works with a range of organizations to deliver a forward look, which helps to identify and prevent potential emergencies.

2. Being ready to respond:

This objective covers the preparedness of all those who might have a role to play in the response to a major disruptive challenge. As well as ensuring that the CCS itself is ready, it is also about tracking the preparedness of organizations at national and local levels, in the public sector and outside, and using the Civil Contingencies Act to develop and embed performance audit and management regimes across all responders, rooted in formal preparedness assessments. The CCS also aims to ensure mechanisms are in place so that the UK is as well placed as it can be to respond to threats which horizon-scanning shows may be at higher risk of occurring.

3. Building greater resilience for the future:

This objective covers action at all levels, from local to international, to build stronger resilience capabilities. It thus covers the processes led by the CCS to drive the delivery of resilience capabilities. It also covers international work to develop closer relations in the resilience field through which we can build mutual resilience. This includes bilateral work and action in the EU and in NATO to seek to build greater resilience capability in partner countries, as well as the EU's own ability to manage a crisis.

4. Providing leadership and guidance to the resilience community:

The CCS aims to tell those involved in delivering and building resilience across the UK what the Secretariat is trying to do, where it is trying to get to, how it will get there and how it will know that it has succeeded - in short, to build consistency and coherence across the UK. Some key means are already in place, especially via the Capabilities Programme and its outputs and the Civil Contingencies Act. The CCS will be focusing on the development of a 'National Resilience Strategy' and reviewing the national exercise programme.

5. Effective management:

This objective covers the way in which the CCS manages itself and its effective management of Cabinet Office processes. Some of it is routine, but nonetheless, important. The CCS aims to sustain its reputation as effective managers of people and money, and as efficient operators of Cabinet Office processes.

The Cabinet Office Civil Contingencies Secretariat (2004) explains that the establishment of the Civil Contingencies Act, 2004, is one of the most significant achievements of the CCS. The Civil Contingencies Act is an act of the United Kingdom Parliament which establishes a coherent framework for emergency planning and response, ranging from local to national level. It also replaces the former Civil Defence and Emergency Powers legislation of the 20th Century.

The Act, and accompanying regulations and non-legislative measures, delivers a single framework for civil protection in the United Kingdom capable of meeting the challenges of the 21st Century. The Act is separated into two substantive parts:

Part 1:

This focuses on local arrangements for civil protection, establishing a statutory framework of roles and responsibilities for local responders. The Act divides local responders into two categories, depending on the extent of their involvement in civil protection work, and places a proportionate set of duties on each.

Category 1 responders are those organisations at the core of emergency response (e.g. emergency services, local authorities). Category 1 responders are subject to the full set of civil protection duties. They are required to:

• Assess the risk of emergencies occurring and use this to inform contingency planning.
• Put in place emergency plans.
• Put in place Business Continuity Management arrangements.
• Put in place arrangements to make information available to the public about civil protection matters and maintain arrangements to warn, inform and advise the public in the event of an emergency.
• Share information with other local responders to enhance co-ordination.
• Co-operate with other local responders to enhance co-ordination and efficiency.
• Provide advice and assistance to businesses and voluntary organisations about Business Continuity Management (Local Authorities only).

Category 2 organisations (e.g. Health and Safety Executive, transport and utility companies) are 'co-operating bodies' who, while less likely to be involved in the heart of planning work, will be heavily involved in incidents that affect their sector. Category 2 responders have fewer duties: co-operating and sharing relevant information with other Category 1 and 2 responders.

Part 2:

This focuses on emergency powers, establishing a modern framework for the use of special legislative measures that might be necessary to deal with the effects of the most serious emergencies. In the UK, emergency powers allow the making of special, temporary legislation to deal with the most serious of emergencies. They are not a means for instigating martial law, for undermining Parliament, banning political parties or anything else of that nature. An essential point to note is that emergency powers legislation is a mechanism for dealing with only the most serious of emergencies that require an urgent response: an instrument of last resort. The Act introduces a range of new features, mostly designed to ensure emergency powers cannot be misused and can be used in a more targeted and proportionate manner.

2.1.1.2 The Flood and Water Management Act, 2010

As a major, legislative step towards improving both flood risk management and the way to manage water resources in the United Kingdom, the Flood and Water Management Act, 2010, was introduced. It seeks to define clearer roles, responsibilities and standards for the creation of sustainable drainage. Whilst the Act places primary responsibility for managing new regulations on Local Authorities, responsibility for the specification, design, implementation and maintenance of sustainable urban drainage systems (SUDS) schemes remains shared between local government, developers, land-owners and even home-owners.

The Flood and Water Management Act, 2010, encourages the use of sustainable drainage in new developments and re-developments. It does this by requiring drainage systems to be approved against a set of National Standards. Approval is required before building can commence and a connection to the sewer can be allowed. It also makes Local Authorities responsible for adopting and maintaining SUDS.

Approval of Drainage Plans

Plans for new drainage systems would need to be approved before construction could start by the SUDS Approving Body (SAB), which will be the unitary or county council for the area. Without the Approving Body's consent, no construction work can commence on a project. The aim is to encourage pre-application discussions between developers, planners, highways authorities and the SAB, in order to avoid delays to the approval system. SUDS will become a routine feature of new construction and pre-application discussions will compel stakeholders to consider SUDS at the earliest stages of site design in order to maximise their use on the development and ensure a smooth approval process. Where both planning permission and SUDS approval are required, the processes will run together. Applications for the drainage system and for planning permission can be submitted together. The planning authority

will notify the developer of the outcome of both the planning permission and drainage approval at the same time, including any conditions of approval.

New Responsibilities for Local Authorities

The Flood and Water Management Act, 2010, compels local authorities to take responsibility for leading the co-ordination of flood risk management in their areas and does this by creating the new role of the 'lead local flood authority'.

The Act defines the lead local flood authority for an area as the unitary authority or the county council. This makes clear who is responsible for managing flood risks, but does not prevent partnership arrangements to make full use of all available capabilities and experience. The Act requires a lead local flood authority to develop, maintain, apply and monitor a strategy for local flood risk management in its area. The lead local flood authority will be responsible for ensuring the strategy is put in place, but partners can help them develop it in the way that suits them best. Local flood risk includes surface run-off, groundwater and watercourses (including lakes and ponds). In developing their flood risk strategy, local authorities must consider the full range of measures possible, consistent with a risk management approach. A Local Surface Water Management Plan should provide the basis for managing local flood risk.

Source - Flood and Water Management Act (2010)

2.1.1.3 Local Government and Housing Act, 1989 (revised 2011)-Provision 156 for Disaster Risk Reduction

This is an act to provide for a national code of local government conduct and to make provision for certain existing grants and financial assistance and planning by local authorities in respect of emergencies. Specific disaster risk reduction provisions are included in Section 156 of this act. Section 156 provides provisions to undertake contingency planning to deal with a possible emergency or disaster if it involves destruction of, or danger to, life or property, and if it is likely to affect the whole, or part, of their area.

Source - Local Government and Housing Act, revised 2011 (1989)

2.1.1.4 United Kingdom-Emergency Powers Act (revised 2005)

This act contains the Government's generic emergency powers legislation in Section 2. It is implied that there must be no expectation that the Government will agree to use emergency powers, and that planning and response arrangements must assume that they will not be used. Section 1 was repealed by the Civil Contingencies Act, 2004 (Preventionweb, 2005).

2.1.1.5 Flood Risk Regulations, 2009

Flood risk management planning is important. Flood risk regulations, 2009, set out where and how to manage flooding so that communities and the environment benefit the most. Flood risk management planning is integral to the way risk management authorities (RMAs) work: it allows authorities to develop a shared understanding of risk from all sources of flooding and agree priorities with communities to manage that risk.

The European Floods Directive has formalised flood risk management planning. The Flood Risk Regulations, 2009, implement the directive and require Lead Local Flood Authorities (LLFAs), the Environment Agency and Natural Resources Wales to prepare and publish Flood Risk Management Plans (FRMPs) on a six-year cycle.

1. The Environment Agency must prepare, in relation to each river basin district:(a) A preliminary assessment map.
(b) A preliminary assessment report in relation to flooding from-

(i) the sea
(ii)main rivers
(iii)reservoirs

2. A Lead Local Flood Authority must prepare a preliminary assessment report in relation to flooding in its area. Similarly, the Environment Agency must prepare a flood risk management plan in relation to each flood risk area identified by it under Regulation 13. A Lead Local Flood Authority must prepare a flood risk management plan in relation to each relevant flood risk area.

Source - The Flood Risk Regulations (2009)

2.1.2 Science Approaches in relation to DRR

2.1.2.1 UK Government Office for Science - Reducing Risks of Future Disasters

The aim of this government initiative has been to provide advice to decision makers on how science can inform the difficult choices and priorities for investing in disaster risk reduction (DRR), so that the diverse impacts of future disasters can be effectively reduced, both around the time of the events, and in the longer term. This work has drawn upon the latest developments in natural and social science, and lessons from past and ongoing DRR initiatives.

This work offers a strategic overview of the present and future potential of science to inform and enhance DRR over the next three decades. It considers disasters whose primary causes are natural hazards. Its focus is on disasters that occur in developing countries but lessons from past disasters in developed countries are also drawn upon. It explores the diversity of impacts and the extent to which these are, or should be, considered by decision makers but does not review in detail the scale of past and present disasters. Based on scientific initiatives, this work suggests the range of current and future impacts that can result from disasters with particular emphasis being given to mortality and morbidity, as well as direct and indirect economic impacts. The underlying drivers that will influence how these impacts could evolve in the future, and how changes in exposure and vulnerability will drive changes in the direction and magnitude of future disaster risk, are explored.

Further, the process by which risk forecasts are produced, and how this might evolve in the future, are discussed. The role of probabilistic forecasts, practical steps required for mapping and modelling vulnerability and exposure, issues related to data collection and management, and building models to forecast changes in future disaster risk are also considered in this government initiative. In addition to the above, the options for responding to risk forecasts are explored. Specific measures identified include the use of financial instruments (transferring risk), investment in early warning systems (avoiding risk), designing resilient infrastructure and restoring ecosystems (reducing risk). The decision-making process is central to the risk response, and the tools that can help with decision-making under uncertainty, including cost-benefit analysis, are discussed. Finally, the case for systematic evaluation of effectiveness is made.

Source - The Use of Science in Humanitarian Emergencies and Disasters (2012)

2.1.2.2 The Use of Science in Humanitarian Emergencies and Disasters

In March 2011, Lord Ashdown presented his Humanitarian Emergency Response Review to the Government. In his report, he provided a comprehensive assessment of the UK and the international community's current response to humanitarian emergencies. Lord Ashdown found that the Department for International Development (DFID) is well respected and well regarded. However, the review also concluded that, in light of the potential future need, there would have to be a step change in the way DFID responded and in the way that science is used in that response.

This report has constrained its scope to disaster risks and uncertainties arising from natural hazards such as earthquakes, tsunamis, storms, heat waves and wildfires, floods and drought, as well as biological rapid onset disasters such as epidemics or pandemics of human, animal or plant diseases (The Use of Science in Humanitarian Emergencies and Disasters, 2012).

The report considers:

- What processes are currently in place for providing advice and how effective they are.
- How well advice is used at present and therefore, what is currently achieved.

- What policy and operational gaps there are nationally and internationally.
- What is missing from current advice to meet the policy and operational needs.
- How better use can be made of current advice and whether new mechanisms and links are needed in a UK or international context.
- Whether there is a need for a formal advisory arrangement such as a Scientific Advisory Group.
- What formal arrangements, similar to those adopted to provide UK emergency advice, would improve the UK Government's operational response to international emergencies.
- What explicit links exist in UK, non-government agency activities.

This report is primarily focused on government, and changes to the way government plans and prepares for international humanitarian emergencies and disasters, including better use of science and knowledge. It discusses how global risk assessments can be used to inform policy makers, and describes several, effective early warning systems for both rapid and slow onset disasters.

It also presents the UK Natural Hazards Partnership, which has been established to provide information, research and analysis on natural hazards for the development of more effective policies, communications and services for the Government. One of the roles of the Partnership is to provide scientific and technical advice to the Cabinet Office on matters relating to natural hazard risks for the National Risk Assessment (NRA). The report presents six recommendations to UK Government, where immediate changes can be made to help and support the use and uptake of science for the benefit of disaster risk reduction (Preventionweb, 2012).

2.2 Legal/Policy and Science Approaches in relation to CCA

2.2.1 Legal/Policy Approaches in Relation to CCA

The UK faces climate change impacts, specifically, threats of flooding and extreme temperature. Accordingly, the Government of the UK has taken early steps to introduce both mitigation and adaptation policies to face the impacts of climate change (Bowen and Rydge, 2011).

As introduced in Section 1.1.3, the Climate Change Act (CCA) is the principal legislative vehicle in dealing with climate change in the UK. The Climate Change Act produces the legislative background for both climate change adaptation and climate change mitigation. However, prior to introducing the Climate Change Act in 2008, there were some other acts, bills and efforts initiated in the UK, focusing on climate change mitigation. Therefore, it is better to have a brief idea of these before reviewing the existing policies on climate change adaptation. The following are some of the major acts and bills applicable to climate change mitigation in the UK.

- Non-Fossil Fuel Obligation (NFFO) was introduced as a part of the Electricity Act in 1989, to generate both nuclear electricity and renewable energy in the energy sector as a mitigation strategy.

- The UK further introduced the Climate Change Programme in 2000, aiming to reduce GHG emission as a mitigation strategy. This programme was updated in 2006, with a target of reducing CO_2 levels to 15-18% by 2010 compared to the 1990 level, and further, to reduce overall GHG emission by 23-25%.

- Another important step taken by the Government of the UK was the imposition of the Climate Change Levy in 2001, replacing the Fossil Fuel Levy (FFL), (Vaux et al.). Accordingly, energy-intensive firms benefit from up to 80% discount by joining the Climate Change Agreement (CCA), which agrees to achieve energy efficiency or carbon-saving targets. The Renewable Obligation (RO) was introduced as the primary renewable energy policy instrument in 2001. Further, the Energy Efficiency Committee (EEC) was set up in 2002 with a target of achieving 1% domestic energy emission reduction by 2005. This was aimed at saving 62TWh energy within Phase One in 2005, and a saving of 130TWh during Phase Two in 2005-2008.

- In the year 2010, both Feed-In-Tariffs and the Carbon Capture and Storage Demonstration Project were introduced by the UK (Bowen and Rydge, 2011). The Carbon Plan, introduced in 2011, aimed to reduce carbon emissions following a vision, plan and specific time periods for achieving the desired levels by government departments. The Feed-In-Tariffs encourage small-scale, low carbon electricity generation in the UK and as a result, over 470,000 installations were registered by 2013 (Department of Energy and

Climate Change, 2013). Among the programmes introduced in 2012, the Energy Bill (EB) and Renewable Heat Incentive (Turner Monique Mitchell and Underhill Jill Cornelius) are prominent. The Energy Bill was passed by Parliament to approve the Green Deal policy which allocates loans for energy saving measures so that consumers may purchase energy efficient improvements for their properties.

The Department for Energy and Climate Change (DECC) takes the lead role in the UK's policy on emission reduction whereas, the Department for Environment, Food and Rural Affairs (DEFRA) deals with the UK's climate change adaptation policy. In addition, the devolved administrations in Scotland, Northern Ireland and Wales, work towards emission reductions with their own targets and programmes. For example, the Climate Change (Scotland) Act was passed in 2009, committed to a 42% reduction of emissions by 2020.

Source - Department of Energy and Climate Change (2013).

2.2.1.1 Climate Change Act, 2008

The major climate change adaptation effort of the UK was the introduction of the Climate Change Act in 2008. The Act provides the legislative framework for both climate change adaptation and mitigation. The Act is considered as the world's first, long-term, legally binding framework to address climate change, in accordance with the Kyoto Protocol (Sustainable Development Unit, 2017). The Act was introduced following a bill presented to Parliament in 2007 and was effective from 26th November 2008. The Act states the requirements for adaptation through Climate Change Risk Assessment (CCRA), the National Adaptation Programme (NAP) and the Adaptation Reporting Power (ARP). The Committee of Climate Change (CCC) and the Adaptation Sub Committee (ASC) advise the Government of the UK and devolved administrations on adaptation strategies (Chartered Institute of Water and Environmental Management, 2015).

Further, the Act established legally binding targets to reduce GHGs by 80% by 2050 and specifically to reduce CO_2 emissions by 26% by 2020 against a 1990 baseline. Similarly, it introduced a carbon budgetary system, starting from 2009, as a five-year budget system to cap the GHG emission levels. The United Nations Framework-Convention on Climate Change (UNFCCC) was established with the view of advising the Government on carbon budgets and to ensure accountability and transparency of the efforts by submitting a report to Parliament. It further agrees to include the level of emissions from international aviation and shipping by 2012. Similarly, the Act further explains the responsibility of the National Adaptation Strategy (NAS) which is to assess the UK's risk of Climate Change and prepare strategies accordingly. The Act makes provisions for financial allocations on domestic waste management through reduction of waste generation, recycling of waste and collection of household waste. In addition, the Act introduced a charge for single use carrier bags.

2.2.1.2 The National Adaptation Strategy (NAS) and the National Adaptation Programme (NAP) to Climate Change - UK

As described in Section 2.2.1.1, the Climate Change Act, 2008, has provisions to establish the National Adaptation Strategy to Climate Change. The Nation Adaptation Strategy aims to provide a coherent and co-ordinated approach to adaptation for the UK. The key drivers for introducing the UK's Climate Change Adaptation Policy are related to:

a.) Weather events, for example: flood management, water resources, coastal erosion, extreme temperatures, biodiversity conservation.

b.) General risk assessments, for example: availability of climate information and adaptation tools within the UK.

c.) The Government's policy initiatives, for example: climate change mitigation policies, UNFCCC, Sustainable Development Goals.

d.) Financial drivers are the economic factors, insurance.

e.) Political will towards adaptation, for example: the Government of the UK has displayed consensus and leadership on the importance of climate change and the need for adaptation.

The NAS was developed in the process of:

1. The establishment of the UK Climate Impacts Programme (UKCIP) in 1997, with the aim of co-ordinating impact research in the UK. UKCIP has played a major role in increasing awareness of the need to adapt and in driving forward action on the ground.

2. The UK Climate Change Programme (CCP:2000, updated 2006) set out the Government's intention to develop a "comprehensive and robust approach to adaptation in the UK" through an Adaptation Policy Framework.

3. The publication of the Consultation over the Adaptation Policy Framework (DEFRA, 2005). This effort was able to gather views on whether stakeholders thought a NAS would be a useful and necessary tool and information regarding climate change adaptation activities across the UK.

4. Introduction of the adaptation provisions within the Climate Change Bill (DEFRA, 2008). The Bill sets out a statutory framework for legislation in the UK. This further requires the Government to develop a statutory adaptation programme to address the risks identified in a national climate change risk assessment.

The first National Adaptation programme was introduced in 2013. The National Adaptation Programme covers twenty-four focus areas across six main themes: the built environment, infrastructure, healthy and resilient communities, agriculture and forestry, the natural environment and business, with a separate chapter on local government. The Government of the UK is developing its 25 year Environment Plan which shows the Government's climate change adaptation strategies which are embedded in their plans and investments (HM Government, 2017). The NAP has identified: built environment, infrastructure, the health and social care sector, agriculture and forestry, natural environment, business and local government as the most vulnerable sectors to climate change. For each sector, the NAP identified the possible risk from climate change and proposed activities under each focus area to minimize the risk of climate change. For example: within the built environment, the risk of floods, extreme temperature and water efficiency are identified as climate change threats. Accordingly, investment in flood risk management, establishment of the National Flood Forum, management of surface water flood risk, spatial planning and activities ensuring that homes and communities are more resilient were introduced.

Source - HM Government (2013).

As DEFRA (2017) details, the First National Adaptation Programme, introduced in 2013, has implemented the following actions in the UK:

- Investing £2.5 billion over six years to improve flood defences and to protect over 300,000 homes.
- Updating the Heatwave Plan for England to protect the population from heat-related harm to health.
- Strengthening planning policy to make clear that sustainable drainage systems should be included in all major, new developments, unless demonstrated to be inappropriate.
- Maintaining over 95% (by area) of England's Sites of Special Scientific Interest (SSSIs) at 'favourable' or 'recovering' condition, and establishing 50 Marine Conservation Zones with 34 new bylaws to protect them.
- Working closely with the food industry to ensure the security and resilience of food supply, using the latest technology delivered through the new Agri-Tech Innovation Centres.
- Constructing a UK Plant Health Risk Register to compare the risks posed by different plant pests and pathogens.
- Committing to develop a 25-year environment plan that takes climate change into account (DEFRA, 2017).

2.2.1.3 Climate Change Risk Assessment (CCRA)

Under the provisions of the Climate Change Act, 2008, the UK Government is required to publish a UK-wide Climate Change Risk Assessment (CCRA) every five years. The Act stipulates that the Government must assess, "the risks for the United Kingdom from the current and predicted impacts of climate change" (Committee on Climate Change, 2017).

The CCRA intends to compare and prioritize the climate change risks over the next 80 years and provide support to the Government and other organizations in making decisions on adaptation policies and actions. Major risks of climate change are: flood risk, extreme temperature events, water resources and ecosystems. The benefits arising

from climate change in the UK are the possible reduction in the number of deaths due to less harsh winters and longer-time availability for growing crops (Chartered Institute of Water and Environmental Management, 2015).

According to the latest climate change risk assessment, completed in 2017, the greatest direct climate change-related threats for the UK are large increases in flood risk and exposure to high temperatures and heatwaves, shortages in water, substantial risks to UK wildlife and natural ecosystems, risks to domestic and international food production and trade, and from new and emerging pests and diseases. A warmer atmosphere can hold more moisture, leading to heavier rainfall and more frequent flooding, including outside of recognised flood risk areas. Higher temperatures will affect public health, infrastructure, business, farming, forestry and the natural environment. Dry periods, when combined with higher temperatures, are likely to result in more severe and prolonged droughts. Projected sea level rises of 50-100 centimetres by 2100 will exacerbate flood risks and accelerate the process of coastal change for exposed communities.

Source - Committee on Climate Change (2017).

2.2.1.4 Adaptation Reporting Power (ARP)

The Climate Change Act, 2008, outlines the powers of the Secretary of State for asking statutory organizations to produce a report on their adaptation options. According to the Adaptation Reporting Power, statutory organizations are required to prepare reports on the impact of climate change and their proposals for adaptation (Chartered Institute of Water and Environmental Management, 2015). 90 organisations have produced reports in the first round. This is applicable to organizations that are responsible for essential services and infrastructure and it is required to make sure that they have an adaptation strategy as part of their risk management process.

The aims of the ARP are: to ensure climate change risk management is systematically undertaken by reporting authorities; to help ensure public services and infrastructure are resilient to climate change and to monitor the level of preparedness of key sectors to climate change. ARP engages directly and indirectly with public organizations through raising awareness, capacity building and provisioning of good examples of effective practices.

Section 2.2.1 discussed the existing legal/policy approaches in relation to climate change adaptation and Section 2.2.2 will discuss the existing science approaches in relation to CCA.

2.2.2 Science Approaches in relation to CCA

2.2.2.1 United Kingdom Climate Impact Programme (UKCIP)

Climate change appeared on the agenda of the UK Government after the talk by the Prime Minister, Margaret Thatcher, to the Royal Society in 1980 and the establishment of the Hadley Centre which published two reports on the impact of climate change in the UK in the mid-1990s. The Hadley Centre for Climate Prediction and Research was a research institution which came into existence in 1990, housed within the UK Met Office. A large proportion of the Hadley Centre's budget came direct from Government via the then Department of Environment. The first of the two reports on the impact of climate change was published following the IPCC's first assessment report in 1990. This report was named as the first national assessment of the possible impacts of climate change for the UK. This report is also known as the Climate Change Impacts Review Group (CCIRG 1991) report. The second CCIRG report was published in 1996 (CCIRG 1996), timed to coincide closely with the release of the second assessment report of the IPCC (Hulme and Turnpenny, 2004).

The climate change adaptation mission was then started after the establishment of the UKCIP in 1997. The UK climate change policy making processes were influenced by the Royal Commission on Environmental Pollution, UKCIP, the Hadley Centre and the Committee on Climate Change. Some argue that the UK climate change policy is inspired by expert opinions (Lorenz et al., 2015) whereas others argue that it has been influenced by geopolitical factors (Owens, 2010).

At the establishment of the UKCIP, its objectives were limited to identify the climate risks within the UK. The UK Government was interested in understanding the impact of climate change within the UK. Hence, they established the UKCIP to fulfil the requirements which were undertaken by national assessments conducted by the Climate Change Impacts Review Group in 1991 and 1996. Later, its objectives were broadened to decision-making for adaptation, exchanging knowledge and ideas and creating adaptation strategies. UKCIP works with scientific research, policy making and adaptation practices by bringing a wider range of stakeholders together working in

climate change. They provide consultancy services, conduct research and establish partnerships. They are interested in working with multi-stakeholders when developing adaptation strategies (UKCIP, 2011).

*2.2.2.2 UKCP*09

The UK has produced climate scenarios/projections since 1980. Apart from earlier climate change scenarios of CCIRG91 and CCIRG96 (Hulme and Dessai, 2008), the present UK Government is working with probabilistic UKCP09 climate scenarios (Tompkins et al., 2010). However, those early projections are aimed at the research community and the policymakers. With the establishment of the UKCIP, UKCP98 and UKCP02 targeted a broader set of stakeholders: infrastructure operators, public bodies, consultants, regulators, private utility companies and industry associations. Compared to other countries, the UK engages in significant levels of climate change research.

The aim of the UKCP09 is to provide projections of climate change for decision-making purposes, specifically at local level. These projections are defined for specific, identified events (Frigg et al., 2015).

Scientific knowledge and expertise provides key inputs in policy making (Braun and Kropp, 2010; Kropp and Wagner, 2010). Since the White Paper in 1999 for Modernizing Government, introduced in the UK, the use of scientific information for policy making has come to the forefront (Tang and Dessai, 2012). The UK Government invested significantly to improve its evidence-based, policy making system. Among these priority policy making areas, climate change adaptation has gained significant traction, apart from climate change mitigation, in the UK, as a result of establishing the Climate Impact Programme (UKCIP) in 1997 (Hedger et al., 2006). This has been further increased with the establishment of the Climate Change Act in 2008 (Tang and Dessai, 2012).

More specifically, the Climate Change Act requires a UK-wide climate change risk assessment every five years. This is to understand climate change risks in the UK and develop a National Adaptation Programme.

Even though projections are used in national and international policy making, they are based on considered scenarios. The first scenarios in the UK were published in 1991 and evolved until the latest projection of UKCP09 developed by a consortium of Defra, UKCIP and the Met Office. This provides projections of climate change when compared to a 1961-90 baseline. The UKCP09 provides information relating to land projections, marine and coastal projections, observed trends in climate data, a weather generator, an 11-member regional climate model output ensemble and spatially coherent projections in the UK. The new UKCP09 is superior to other previous projections since it quantifies uncertainties explicitly in a probabilistic way. Further, it provides specialized climate information for administrative regions, river basins and marine regions as well. They also encourage participation of a range of inputs for decision-making (Tang and Dessai, 2012).

The UK Climate Change Risk Assessment has been identified as an example of interactions between politics and evidence-based policy making (Tangney, 2016). The Government of the UK has introduced and invested in policy focused science through introducing UKCP09 and CCRA and some knowledge brokerage, for example, UKCIP, the Environment Agency's Climate Ready Programme and the regional climate partnerships (Porter et al., 2015).

Section 2 described the existing legal/policy and science approaches in relation to climate change adaptation and disaster risk reduction. Section 3 details the methodology of the study. It includes a brief outline of the ESPREssO project, the key challenges which ESPREssO seeks to address and the details of the methods used for the study.

3 Research Methodology

3.1 About ESPREssO

ESPREssO (Enhancing Synergies for Disaster Prevention in the European Union) aims at contributing to a new, strategic vision on how we can approach risk reduction and climate change adaptation, thereby opening new frontiers for research and policy making.

To achieve this goal, the project addresses three main challenges:

1. To propose ways to create more coherent national and European approaches to disaster risk reduction, climate change adaptation and resilience strengthening.

2. To enhance risk management capabilities by bridging the gap between science and legal/policy issues at local and national levels in six European countries.

3. To address the issue of efficient management of trans-boundary crises.

Accordingly, ESPREssO undertook a comprehensive and scientific research methodology to review the existing, legal/policy and science approaches in relation to the three ESPREssO challenges as stated above. A brief outline of the three ESPREssO challenges are as follows:

3.1.1 Climate Change Adaptation vs Disaster Risk Reduction

The links between Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) have become increasingly clear as climate change has increased the occurrence of damaging, extreme weather events. The number of weather-related disasters has increased in recent decades (Guha-Sapir et al., 2012). In the context of climate change and extreme events, adaptation is the key countermeasure, whereas DRR often remains a peripheral topic (Birkmann and von Teichman, 2010). Thus, the gap between CCA and DRR efforts remains wide open, institutionally, conceptually and in terms of research organisation (Thomalla et al., 2006) and the external politics of the EU (Schipper and Pelling, 2006).

Today, research is about approaching disasters in the framework of the CCA. DRR and CCA seem to remain isolated from each other (Gaillard, 2010). While the interdependencies are evident (Becker, 2009), it is still not entirely clear how to achieve CCA outcomes through improved disaster management policies, planning and risk management. In the last decade, attention was paid to the need for a greater discussion on the issue of disaster governance (Tierney 2012; UNDP 2010; van Asselt & Renn, 2011) and resilience (Cannon & Müller-Mahn, 2010). It seems that these concepts offer an opportunity for the integration of CCA and DRR.

3.1.2 Science vs Legal/Policy Issues in DRR

Scientific capabilities and institutional capacities to approach disaster management have not proceeded at the same speed up to now. Science has developed innovative concepts and tools that institutional capacities can hardly use under the current legislative framework. Typical examples are the resistance to widespread use of early warning and multi-risk methods. The relation between knowledge production and institutional responses is crucial to manage modern, increasingly complex disasters. The definition of the role, tasks and responsibility allocation and distribution between scientists and practitioners is a topic that deserves more attention. In their role as advisers, scientists have emerged as a form of the fifth branch of government. However, even though the growing dependence of regulatory agencies on scientific and technical information has granted scientists a greater influence on public policy, opinions differ as to how those contributions should be balanced against other policy concerns (Jasanoff, 2011; Jasanoff, 2009).

3.1.3 National Regulations for the Preparation to Trans-Boundary Crises

Frequently, disasters have cross-boundary impacts. Recent examples are the Aila Cyclone that affected India and Bangladesh in 2008, and the Kashmir earthquake in 2005 that affected both India and Pakistan. Recent European

cases include the Central Europe flood, affecting Eastern Germany and Hungary, the extreme drought and heat wave that hit several countries in Europe in 2003 and caused the destruction of large areas by fires, and the earthquake that hit the borders between Italy and France in 1995. Experience shows that although there is a general tendency to co-operate, as the number of stakeholders increases, so too does the competition among them, while different regulations can hinder the organisation of an effective response. In fact, the large and increasing number of public and private actors is one of the major complexities in disaster response and risk management (Granot, 1997; Schneider, 1992; Kory, 1998; Katoch, 2006). The increase in the number of stakeholders and the change in stakeholder backgrounds have, arguably, important repercussions on efficient actions in disaster settings (Telford and Cosgrave, 2007). As Quarentelli points out, "Government and private groups may have different interests, tasks and goals," (Quarentelli, 1997:48). However, whilst there seems to be general consensus about the growing number of actors, there is a surprising lack of in-depth analysis of the consequences and of the actual impact that so many actors have on the way humanitarian action is handled.

3.2 Research Methods used for the Study

The aim of this study was to review the existing, legal/policy and science approaches in relation to the three ESPREssO challenges as described in Section 3.1.

At the initial stage, a literature review was conducted to identify the key challenges and gaps related to the three, key ESPREssO challenges. Thereafter, based on the initial findings, a conceptual framework (figures 3 & 4) was developed which led to identifying the key themes for the study. Once the key themes were finalised, the data collection instruments and the reporting template for the national report were identified.

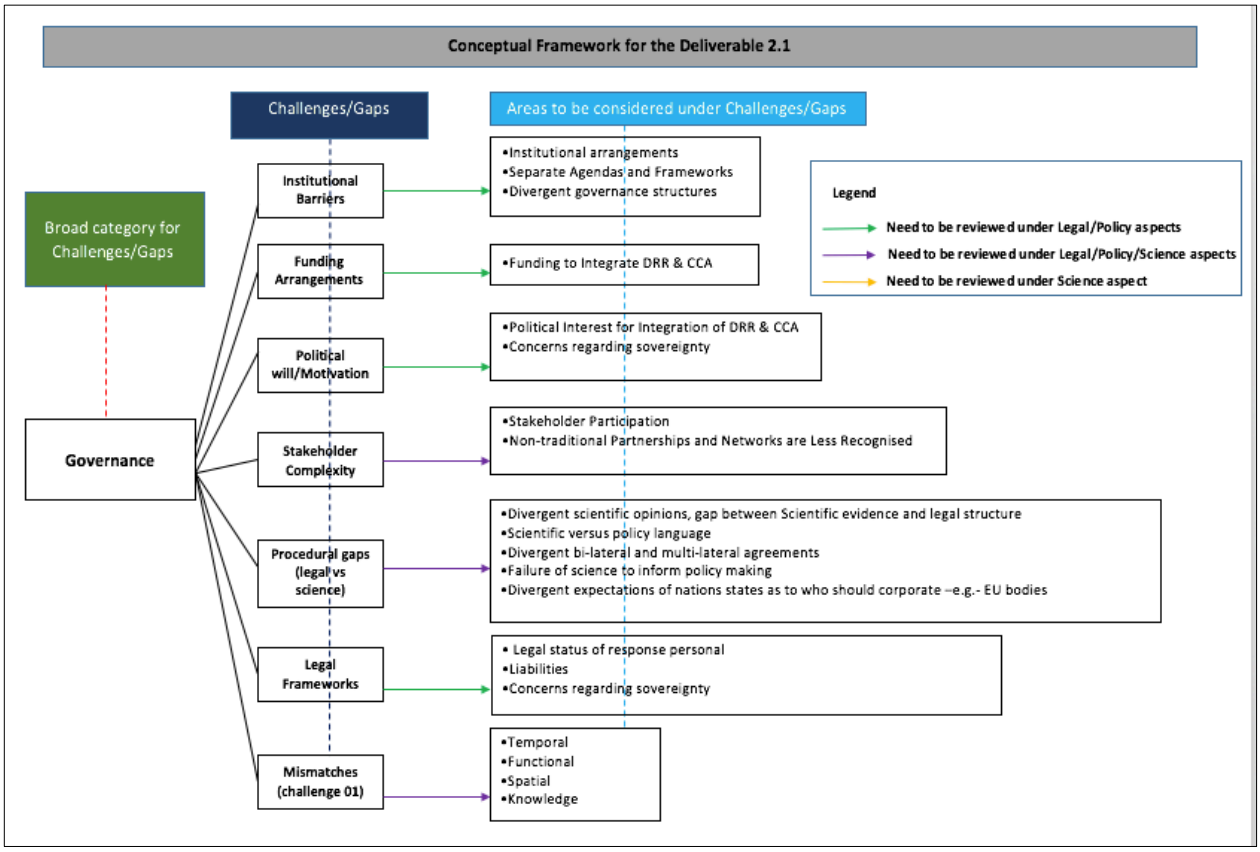

Figure 4- Conceptual Framework based on the preliminary literature review (part 1)

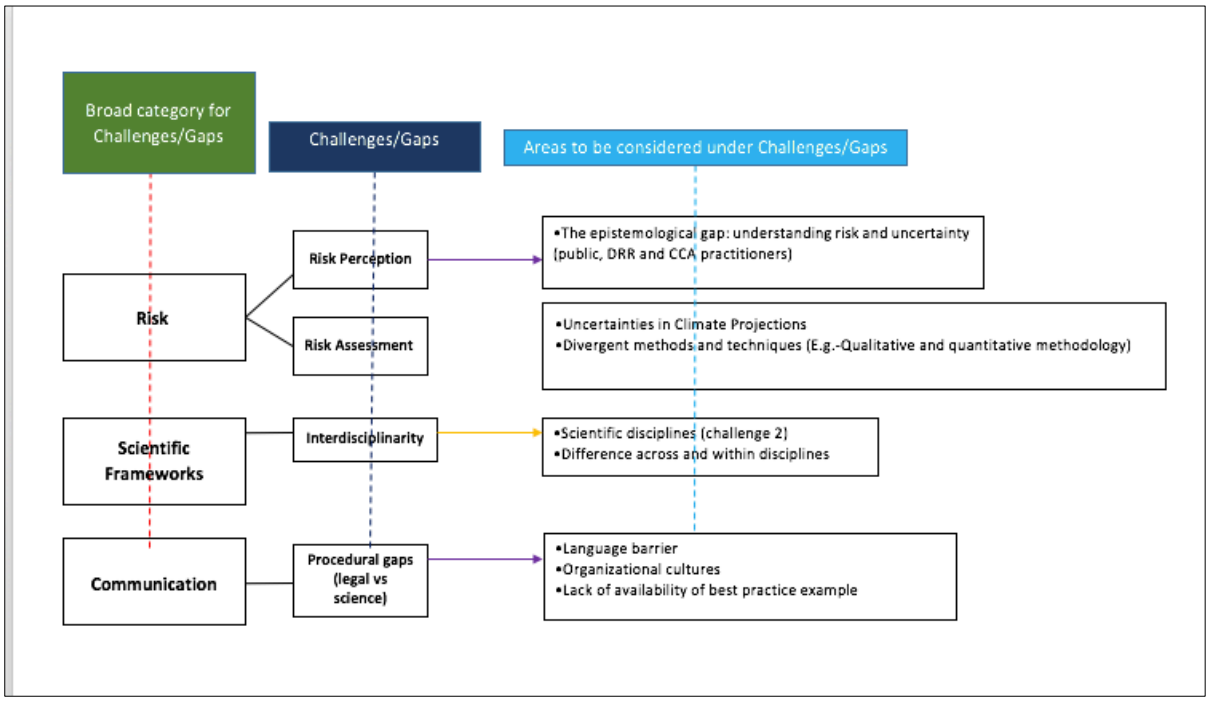

Figure 5- Conceptual Framework based on the preliminary literature review (part 2)

The key data collection instruments are the desk-based literature review and semi-structured, expert interviews. The desk-based study had two purposes. The first was to identify the legal/policy and science approaches available in the country. Secondly, the desk-based literature review identified the existing issues and critically reviewed the legal, policy and science approaches. The desk-based literature review was the ideal data collection method to initiate the study. As stated above, one of the objectives of the study was to identify the legal/policy and science approaches available in the country. In order to identify already available legal/policy and science approaches, the best tool was the desk-based literature review.

Semi-structured, expert interviews and focus group expert discussions were identified as the best tools for primary data collection. However, considering the difficulty in gathering experts to a single venue at one time during this limited study period, it was decided to go ahead with the expert interviews. Since this is a review of legal/policy and science approaches, it was not vital to interview the community for this study. Community engagement is a well-known tool and a strategy for data collection but, individuals may not have expert knowledge on the existing laws/polices or frameworks. Community engagement would have been ideal if the study meant to review the existing disaster risk in the neighbourhood or village. For interviews, it was necessary to select experts from both CCA and DRR and from different types of institutions.

The project team aimed to conduct comprehensive interviews with at least 10 experts. Accordingly, around 40 email invitations were sent to potential experts, keeping in mind the response rate for an interview may be 25%. However, the project team received a 37.5% response rate for interview invitations and accordingly, 15 interviews were conducted with disaster resilience and climate change adaptation experts in the UK. The sample represented academics, practitioners, NGOs, representatives from government bodies and so forth.

Once the data were collected, they were qualitatively analysed by using QSR-NVivo version 11 and thereafter, based on the identified key themes, mind maps were developed to understand the context for each and every issue and to identify the influence of the existing legal/policy and science approaches. The figure below demonstrates the node structure of the NVivo analysis:

Funding Arrangements	7	31
Funding sources, alloc...	7	19
Policies legal backgrou...	6	12
Information Management	8	50
dissermination of best...	3	5
Language or communi...	8	40
Academic & practiti...	6	13
Communication CC...	7	13
Practitioners & gene...	7	13
working with nation...	0	0
Support of legal-policy...	4	5
Institutional Arrangements	9	36
Challenges in the exsis...	9	20
Divergent government...	5	9
Need for Integration	4	7
Interdisciplinarity	0	0
Mismatches	7	23
Competition between...	6	16
influence-support mad...	0	0
Lega-policy promote c...	3	3
Spatial-functional-tem...	3	4
ways spatial-functional...	0	0
Political will-Motivation	6	20
existing legal-policy ba...	4	5
Identified issues in the...	2	2
Political will to integrate	4	5
Political will to tackle tr...	4	8
Procedural gaps and lega...	5	6
Risk Assessment	3	5
Challenges faced by C...	3	4
legal-policy influence t...	1	1
Risk Perception	7	16
Legal-policy framewor...	3	3
Perceiving risk	7	13
Stakeholder Complexity	7	27
Existing level of stakeh...	7	17
their roles & respon...	4	4
who are them	4	8
Legal-policy backgrou...	6	10

Figure 6-Key Nodes for NVivo-Analysis

4 Analysis, Findings and Discussion

This section critically reviews the existing legal/policy and science approaches based on key challenges/gaps identified.

4.1 Challenges/Gaps related to GOVERNANCE in the existing Legal/Policy and Science Approaches

4.1.1 Institutional Barriers (working with different governance bodies)

Institutional barriers were highlighted as one of the major challenges to integrate CCA and DRR as well as to function within CCA and DRR domains.

The UK's DRR efforts or strategies have a strong, legal and regulatory framework which provides clear, legal and institutional settings at national and local levels. As described in Section 2.1.1.1, establishment of the Civil Contingencies Act is one of the great achievements in relation to disaster management. However, one of the key limitations of the Civil Contingencies Act is its limited focus on preparedness and capacity of adaptation events (UNISDR EC OECD, 2013). This idea was further strengthened by the preliminary data analysis. As identified from this, in the UK, DRR is separated by hazard. Therefore, a great deal of focus is only on disaster response and recovery rather than disaster risk reduction. An expert on disaster risk reduction, who took part in the ESPREssO data collection, described this context in detail as follows:

"There is low response for disaster risk reduction and climate change adaptation when compared to disaster response. There are plans for immediate response when there is a disaster, but, there is no particular attention to reduce the disaster risk. In DRR and I would think the same in CCA, there's more emphasis given to assets than the actual impacts and effects of a disaster. This idea is the same throughout the entire humanitarian community."

As a result of this context, the institutions for disaster response and recovery, disaster risk reduction and climate change adaptation are typically separate. As emphasised by one of our experts who works for a key government agency in DRR in the UK, the Department for Food and Rural Affairs in England (DEFRA) sets out the policy context for the Environment Agency UK, based on climate change adaptation, flood risk management and coastal erosion policies. However, these subjects are dealt with by two, different government bodies. As a result, when the policy context is developed for the Environment Agency, it does not always appear that there is a direct link among these subjects. Accordingly, all 15 experts in our study mentioned the need to provide the mandatory legal background to relevant authorities to develop policies and also, to implement them by themselves.

Further, even though the Civil Contingencies Act provides a coherent framework for preparedness and response, it does not always work effectively due to institutional barriers. The main criticism is that the existing frameworks are geared to deal with a normal situation. Accordingly, 12 out of 15 experts emphasised that the existing frameworks are good for a normal, steady state of working. It has been highlighted that when there is a normal, steady state, it works as a perfect cycle but, it does not provide any further guarantee to reduce the disaster risk or to reduce the vulnerabilities of the communities in the UK. The remaining three experts didn't have any specific idea about this.

Another key issue which emerged related to institutional barriers and was the lack of standards, regulations or measures. It was highlighted that there are government regulations for large-scale commercial developments such as shopping complex development. In this case, the developer must have precautions to reduce the potential environmental impacts which may lead to the generation of a natural hazard. However, these kinds of government regulations are not applied to large-scale housing developments which may have the same environmental impact. Therefore, it has been revealed that there should be a coherent government framework to provide guidance to the government institutions to manage and monitor similar situations.

The issue of devolving powers to the local government bodies was also identified as a key institutional barrier. As highlighted, the Environment Agency or the county council, have powers to take action to reduce disaster risk by providing solutions for potential hazards, for example, improving the river banks to reduce flood. However, it has been reported that the local town councils do not have any legal mandate or capabilities to deal with these. Therefore, as a result, if the Environment Agency or the county council are not involved in reducing disaster risks in the governing area of the particular town council, they have to find their own ways to live with potential disasters,

rather than findings ways to reduce the disaster risk. The following is a quote from one of the climate change adaptation experts who participated. He represents the academic view:

"So, it's a town called (kept intentionally blank), and that has its own administrative base, a town council, but, it sits underneath (kept intentionally blank) as the regional authority and I think it's (kept intentionally blank) Council. And, yes, it's very clear that there is no capacity and legal mandate for the town council to protect itself from sea level rise, nor from flooding. So, there is alignment in terms of responsibilities and in terms of where power lies for risk reduction and for climate change adaptation and none of that is at the local level. It's all at the County Council seat in (kept intentionally blank)."

Adding to the preliminary findings, UNISDR EC OECD (2013) states that in the UK, current administration for risk governance is able to deal only with local boundaries rather than trans-boundary issues. Therefore, it recommends setting up systems to monitor the implementation of national guidelines at local levels and provide additional capacity building required to enhance risk management planning.

In addition to the issue of devolving the powers, Harris (2014), emphasised that due to continuous budget cuts in the UK, there is a shortage of staff working in adaptation, specifically in local authorities. Accordingly, the local authorities are concerned about immediate issues rather than future plans, hence, adaptation is no longer considered as a priority in local authorities in the UK (Porter et al., 2015). This indicates the need to have a long-term vision and common framework within government institutions to reduce the future vulnerabilities of society, rather than merely work on immediate issues. Further, the Committee on Climate Change (2015) highlights that regulatory, institutional and behavioural barriers hinder the introduction of adaptation measures. Accordingly, UK policies do not necessarily provide sufficient incentives for organisations to take adaptation into account when compared with other, short-term priorities. For example, limited evidence shows that climate risks are being evaluated fully or transparently alongside short-term priorities. As a whole, this indicates that the institutional and policy framework in the UK is geared to mainly deal with short-term activities which involve disaster response and recovery but not exactly to reducing the vulnerability of society to CCA or DRR. One of our experts, who represented a national NGO on disaster risk reduction, pointed this out and stated:

"No, there's no focus on disaster reduction. There's no focus on climate change adaptation or mitigation. The focus is on reducing public sector spending, it's on housing numbers, or it's on generating economic activity."

Another institutional barrier is too many separate groups which deal with CCA and DRR. In some cases, even within CCA and DRR, there are so many diverse groups. It was noted that the local authority context is fairly fragmented as there are separate departments for planning, local flood management, environment, climate change adaptation and a separate department for resilience. Also, the current institutional structure or its legal mandate do not facilitate co-ordination between these departments. All experts in our study mentioned this as one of the key issues. One of the CCA and DRR experts from an academic background elaborated on the issue as follows:

"Those different sectors do not always talk to each other, even when they do, they don't always collaborate. And sometimes for very good reasons, such as they're just too busy. They're too busy trying to deal with the emails that come in or the telephone calls that come in. But, that lack of collaboration is very noticeable in many areas. And it's the same if you go to some of the agencies. If you look at them, they simply say, I don't know, water quality and flood risk management have many areas where they need to collaborate and can have joint projects but they don't always necessarily talk to each other effectively or co-ordinate."

Throughout this section, the fragmentation of CCA and DRR was highlighted and the way in which institutional barriers have helped to create this fragmentation. Accordingly, as revealed from the preliminary data analysis as well as from the literature synthesis, there is a huge need to integrate CCA and DRR efforts in the UK. In addition, it is necessary to remove the fragmentation within the DRR context as well as within the CCA context. Figure 6 summarises the key issues discussed under the heading of 'Challenges in the existing Government Structures'.

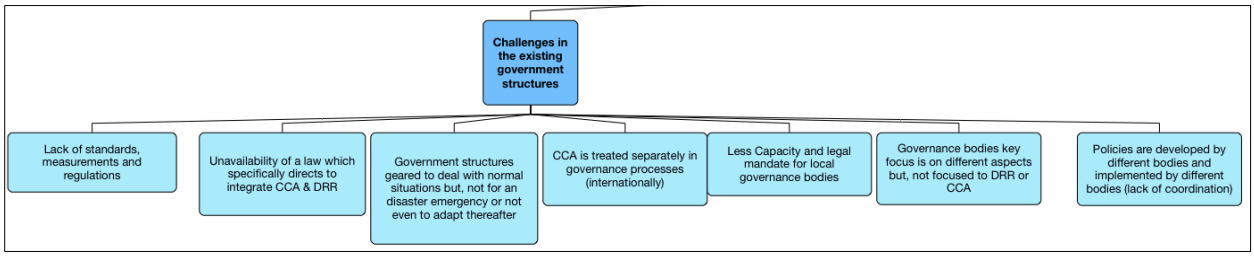

Figure 7- Challenges in the existing government structures

Further, figure 7 summarises experts' comments on the need for integration of CCA & DRR:

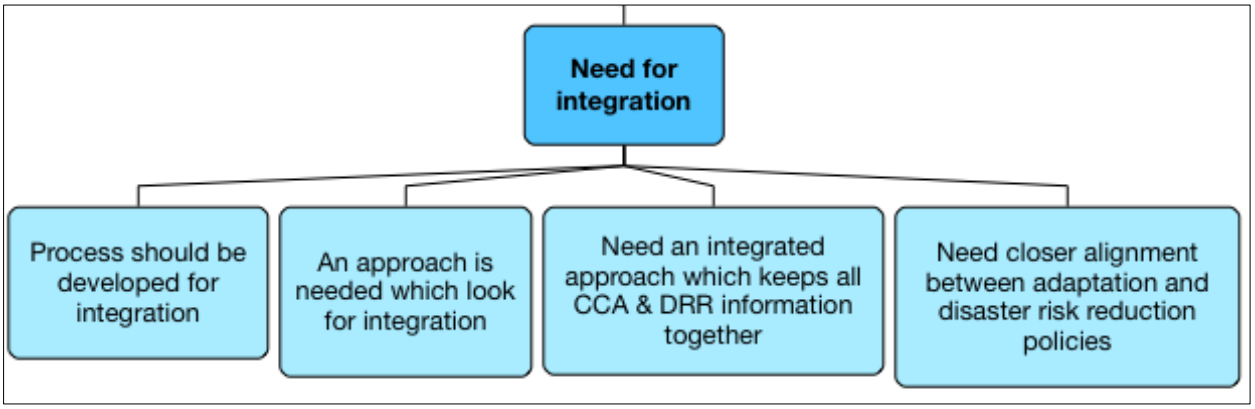

Figure 8-Need for integration of CCA and DRR

4.1.2 Funding Arrangements

In the UK, the key issue regarding funding allocation is linked to the institutional barriers. In Section 4.1.1, it was revealed that the key institution focus is on disaster response and recovery rather than disaster risk reduction or adaptation. Accordingly, the same issue is applicable to the funding context. However, when it comes to funding, key funds are allocated only for disaster response, not even for disaster recovery. As the Committee on Climate Change (2015) highlights, currently, most of the activities are limited by the government funded programme. As a result, in the event of a major disaster, contingency funds are available for immediate response activities only. Hence, there are no recovery funds made available by the Government or local authorities to cover damages to individuals and companies. Further, there are no specific policies for financial provisions for risk management planning (UNISDR EC OECD, 2013). This issue was clearly highlighted from the preliminary data analysis as well. As revealed, the current legal and policy context, which is bound to the Civil Contingencies Act, 2004, makes provision mainly for disaster response, but not for disaster recovery, disaster risk reduction or adaptation.

However, even within the available funding schemes, there are many issues with funding allocations. One of the issues of the UK's DRR strategy is that there is no specific and comprehensive estimation of budget allocation for disaster risk reduction efforts (UNISDR EC OECD, 2013). With recent budgetary controls in all sectors in the UK, the allocation for DRR programmes has been greatly affected. Adding to this, preliminary data analysis highlights that even within the available funding, funding for CCA is increasing and sizeable, whereas funding for DRR is poor. There are two key reasons for this situation as highlighted from the expert interviews. Most of the government funding bodies have a belief that DRR is a scenario which might or might not happen, whereas CCA is scientifically proven with scientific data and figures. Therefore, funding is released based on this scientific basis. The second reason is media attention. The media is more interested in climate change than disaster risk reduction and, therefore, CCA gets more political attention and more funding opportunities. However, as revealed from the analysis, it was highly recommended to integrate CCA and DRR, as then this funding allocation issue could be resolved. Figure 8 summarises the findings regarding the funding issue within its current policy context.

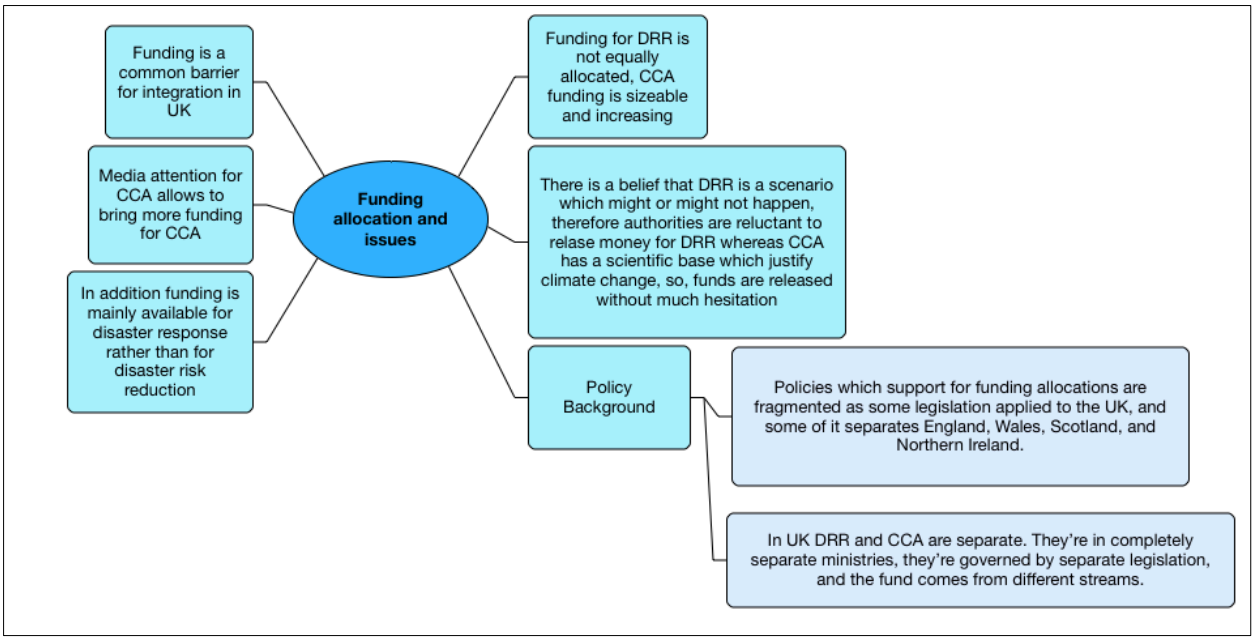

Figure 9- Funding allocations and issues

4.1.3 Political Will/Motivation

Similar to funding allocations, the main, key political attention is for disaster response rather than for CCA or DRR. However, within that context, CCA has more attention than DRR. As Desai et al. (2012) highlight, climate change adaptation was influenced by the changes in the political party system. For example, planning policies 1 and 25 were withdrawn by the party elected in 2010. This resulted in introducing centrally initiated adaptation approaches towards more decentralized, local level, 'bottom down' approaches. National, regional and local policies, from a number of different components of governance, have created and extended support for adaptation (Ingirige et al., 2013).

In addition, the UK Climate Plan was introduced in 2015 to control and take a lead role in emission reduction. It aimed to reduce temperature rises to below 2^0C, to deal with carbon budgets and to end the use of coal for power generation, along with a competitive, energy efficient, low carbon economy (Harper and Metternich, 2015). According to the EU Renewable Energy Directive, the Government of the UK is required to generate 15% of energy from renewable sources by 2020. Whilst some predicted that the UK referendum on leaving the EU will significantly affect the existing climate change policy and its related targets, experts revealed that there will not be any changes to the agreed level of emission reduction in the UK except for time scale changes. Further climate change in the UK has been identified as the key driver for business success (Seabrook, 2016).

According to the report published by the Committee on Climate Change in the UK, the impact of climate change and its devastating results have been identified in the coming decades. However, the report emphasises that the UK is poorly prepared for the inevitable impacts of global warming. Among these effects, deadly annual heatwaves, floods and coastal erosion, water shortages, natural environment and difficulties in producing food, are the most affected sectors in the UK (Carrington, 2016). Within this context, the experts' data analysis highlighted that there is a gap in understanding the concepts of CCA and DRR in the current political context. Accordingly, the available systems and policies do not support the political bodies in understanding and digesting these concepts correctly in order to take action. As a result of this, it is noted that the Environment Agency is struggling to embed CCA into the work they do to reduce society's vulnerability. Currently, they work on either disaster response or DRR but would like to embed CCA in their work. However, it has been identified that there is no clear political steer for this.

Accordingly, the key actions highlighted from the analysis to gain political attention include developing a co-ordinated system of government to identify the concepts of CCA and DRR and developing a policy/legal background to gain political attention. Figure 9 summarises the findings:

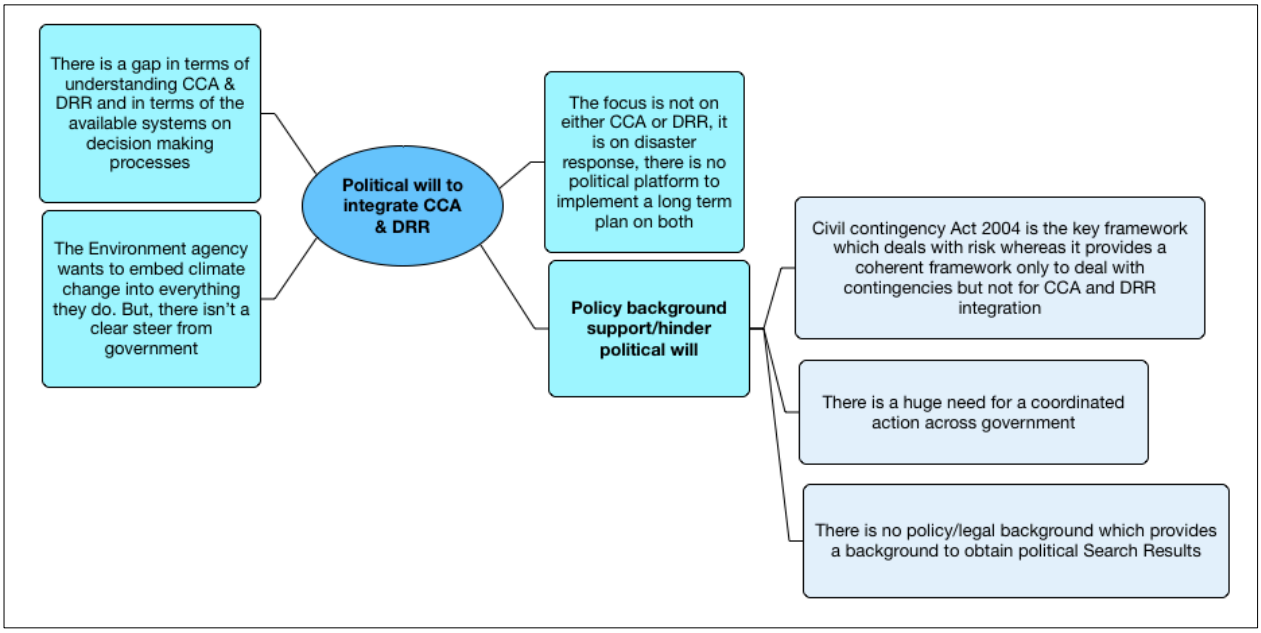

Figure 10- Political will, CCA and DRR

4.1.4 Stakeholder Complexity

The UK has achieved much progress in stakeholder management. Both in CCA and DRR efforts, stakeholder participation is identified as an important element. Scientists and stakeholders together can develop effective adaptation strategies with the knowledge of factual information along with local knowledge and experiences over time (Conde et al., 2005). One example of stakeholder participation in the UK adaptation strategy is the establishment of UKCIP, with the view of providing information to climate change decision-making. These decision makers represent the Government, private sector, trade groups and other interested groups. Meantime, the objectives and focus of UKCIP have changed over time, towards facilitating partnerships among stakeholders and promoting risk management. However, there are missing stakeholders within the risk management at UKCIP for example: charitable organizations, some sectors in the economy and so forth (Scheffer and Carpenter, 2003). Even though UKCIP has introduced stakeholder engagement (Tompkins et al., 2010), there are some concerns about the level of knowledge of the stakeholders included in the NAS (Lorenz et al., 2015). Even within the first NAP, the UK does not have adequate space for the household representation for an adaptation strategy (Porter et al., 2014).

Similarly, the UK Government faces other issues in translating legislation into action because of the lower representation of its stakeholders. For example: local media representatives were not involved in local preparedness plans and a lack of preparedness among the utility providers, due to their poor engagement in flood preparedness measures. Even though political will has advanced public sector involvement and efforts in climate change adaptation, private sector involvement was limited (Desai et al., 2012). However, as a whole, it is noted that the UK policy is to devolve responsibilities to the local context and, accordingly, responsibilities are down to the community level, so, community members are actively engaged.

Furthermore, the UK's DRR strategies ensure representation of different stakeholders, for example: the UK Met Office established the Natural Hazard Partnership between 12 technical and scientific agencies to provide information on natural hazards. The UK DRR strategies include many stakeholders including officials, specialists, volunteers and the business sector. In addition, the UK has undertaken significant efforts to work directly with citizens to increase resilience among communities. For example, the Natural Hazard Partnership consortium is playing an important role in improving the quality of information and is providing more co-ordinated and coherent scientific and technical advice for the Government and the resilience community (UNISDR EC OECD, 2013). These findings were further strengthened by the data analysis and it was revealed that the current UK policy to devolve responsibilities to the local context is working well. There is good stakeholder engagement at the local and community levels. Further, the Environment Agency plays a key role in stakeholder engagement and they have a strong stakeholder base which they use for disaster response as well as for DRR. Specifically, it was noted that the

current legal/policy background is the key basis which produced provisions for a strong stakeholder base at the Environment Agency. The Environment Agency has the legal mandate to engage stakeholders and the Flood and Water Management Act lists the set of stakeholders to be engaged. The following is a summary of the context:

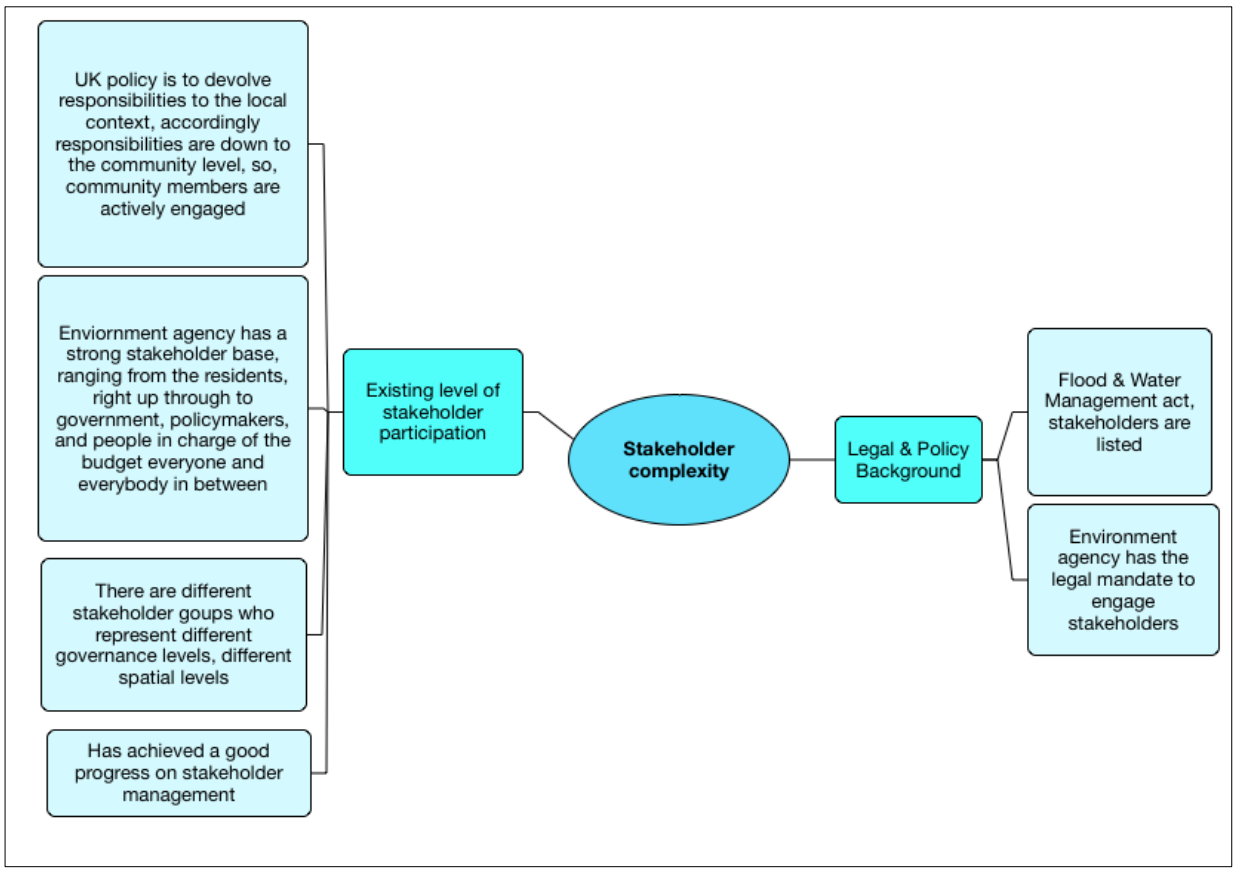

Figure 11- Stakeholder complexity in CCA and DRR

4.1.5 Procedural Gaps and Legal Frameworks

There are procedural gaps and legal frameworks that hinder the efforts of CCA and DRR within the UK. For example, the Civil Contingencies Act predominantly focuses on preparedness and capacities when dealing with disasters and the Act provides a sound framework for emergency management. Further, the Act was set to modernise and update out-dated legislation in relation to disaster management in the UK (UNISDR EC OECD, 2013).

However, UNISDR EC OECD (2013) criticised this for several reasons. For example, they emphasise more benefits could be gained if proper co-ordination was determined by the Act, between all stages of the disaster cycle: prevention, preparedness and response. As they further state, the overall co-ordination of response activities could be problematic due to different levels of capacities among organisations. Bosher et al. (2007) describe that the Act's emphasis was limited to emergency response and, accordingly, there is no opportunity for the proactive requirements of disaster management.

Furthermore, the devolved administration system makes it difficult to co-operate in the case of trans-boundary issues arising. This is because the risk governance within the devolved administrations deals only with the boundaries of the local resilience efforts (UNISDR EC OECD, 2013).

This was clearly demonstrated from the data analysis. Accordingly, it was revealed that the UK has the attitude and belief to be self-dependent during disaster response and recovery, as well as in DRR and CCA. Linking to political willingness, it was discovered that the political bodies in the UK are not much interested in trans-boundary crisis management and therefore, there are no procedures to effectively work with neighbouring nations to manage them. One of the CCA and DRR experts in our study, who represents academia, explained this issue in detail as follows:

"At the UK level, so we're talking about (Intentionally left blank), I see no political will whatsoever to have much to do with major issues outside the UK. It's incredibly insular, there's almost zero recognition that other countries have a lot of expertise to offer. There was this brilliant article where some (Intentionally left blank) government person came over to talk to the (Intentionally left blank) about flood-risk reduction, and the way it was reported is: (Intentionally left blank) Experts Seek English Advice on How to Deal with Floods. There's no element of exchange. There was no element of mutual understanding. There was no recognition that even though the (Intentionally left blank) are international leaders in dealing with storm surge. The UK should at least look outwards and recognise they always have something to learn. The whole attitude was insular, almost like England and Wales know everything, and so, people come to us for advice, rather than saying, look, we can help each other, we can get help from each other, we can teach each other, we can learn from each other, we can exchange."

Figure 11 summarises the procedural gaps in the UK for trans-boundary crisis management and figure 12 links procedural gaps with political willingness for trans-boundary crisis management and the current context for that.

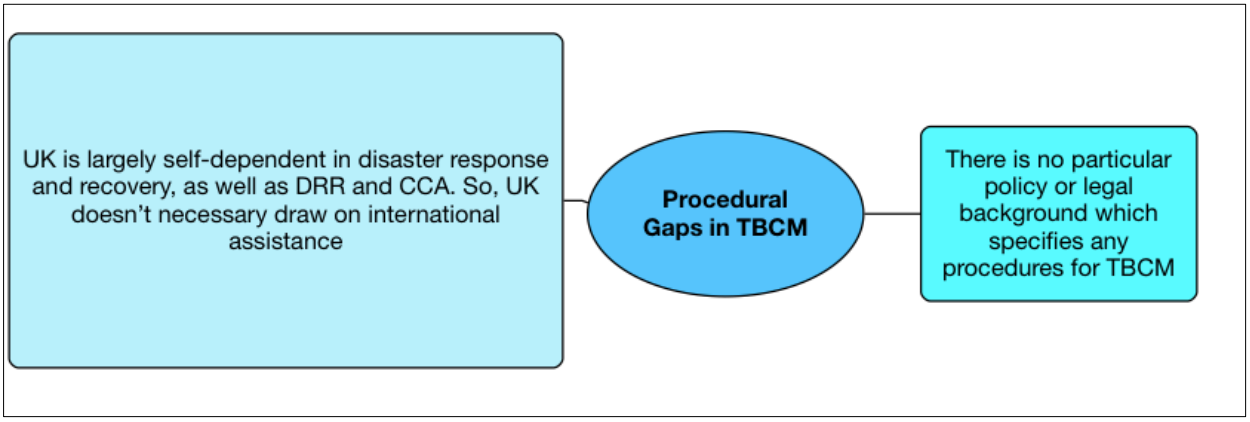

Figure 12-The UK's position in trans-boundary crisis management

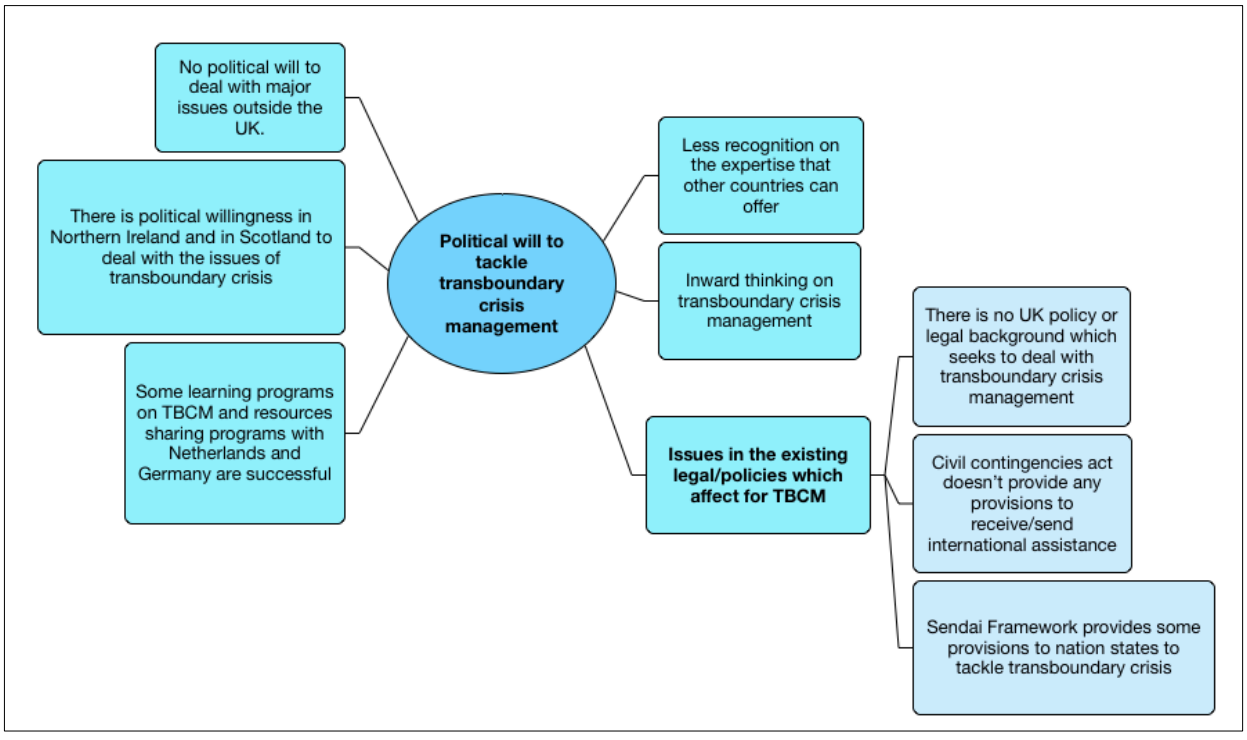

Figure 13-Political will to tackle TBC

4.2 Challenges/Gaps related to RISK in the existing Legal/Policy and Science Approaches

4.2.1 Risk Perception and Risk Assessment

4.2.1.1 Risk Perception

Climate risks are assessed by scientists (Parry, 2007), and hence, the risk perception among the public is different to the scientists' view point (Slovic, 1987, cited in Taylor et al., 2014). Moreover, climate risk awareness among the general public is limited due to many reasons (Kahan et al., 2012). For example, this may be due to: scientific illiteracy (Pidgeon and Fischhoff, 2011); their bounded rationality and nature which is either based on consciousness or heuristic views of climate risk (Kahneman, 2003) or cultural cognition (Kahan 2010, cited in Taylor et al., 2014). However, public perception about climate risk is an important element in disaster management as well as adaptation strategy, since members of the public engage with the effects of climate change. However, little empirical evidence is available on climate risk perceptions on climate change adaptation when compared to climate change mitigation (Taylor et al., 2014). According to the disaster management experts in the UK, this is a common issue, and they suggest developing common guidelines, in simple language, to be disseminated to the general public including professionals, politicians and any other stakeholders. This will enable some common understanding between the general public and the other stakeholders.

Further, it was highlighted that in the UK, there are different opinions about the impact of climate change and natural hazards. Some believe that the impact of natural hazards to the economy, infrastructure and residents will be marginal, whereas others argue that the occurrence of extreme weather events will increase and climate effects will be significant (UKCIP, 2002). For example, with the changing climate, the threat of flooding will be significantly increased in the UK (Bosher et al., 2007); the risk of floods would be increased four times by 2080 (Kapucu, 2009). However, generally, people are reluctant to accept and recognize the possibility of the potential future risk of natural disasters. Therefore, additional efforts should be made to educate citizens on prevention to build more resilient communities (Kapucu, 2009). The culture of risk prevention is weak because risk awareness is low among the population of the UK (UNISDR EC OECD, 2013). In addition, many people do not believe that there is a relationship between the occurrence of weather events and climate change, including some scientists, the media and general public (Pall et al., 2011; Gavin and Marshall, 2011). Limited studies have been conducted to identify the extent to which climate awareness is important for climate change adaptation decisions (Taylor et al., 2014).

In addition, it was identified that some NGOs, some private sectors and some government entities operating in the UK, lack risk experts. As a result, there is confusion over risk-related concepts such as: What is the residual value? What is the control measure? What is mitigation? What is management? Also, it is worth highlighting that there is a fundamental lack of understanding on the concept of risk. UNISDR, IPCC and UNFCC have defined it in a similar way but there are different understandings of the concepts such as vulnerability and resilience.

4.2.1.2 Risk Assessment

As mentioned earlier, UK climate change risk assessment is based on UKCP09 climate projections. Accordingly, this assessment helps country-wide risk management, preparedness and planning, with the help of a multi-hazard approach and within a five-year time horizon. Their risk matrix provides an efficient method to decide the level of warning as an input to the UK's early warning system, for example: the Flood Forecasting Centre provides flood forecasts and early warnings (UNISDR EC OECD, 2013). It is recognized that UKCP09 is strong in terms of understanding, higher acknowledgement of uncertainty and the larger amount of user input in UK climate projections (Tang and Dessai, 2012). Climate information is the basis for long term climate change adaptation planning in the UK. A decade ago, there was a lack of climate change information among the officials of local authorities (Porter et al., 2014).

However, there are many aspects to be further considered for an effective risk assessment system for the UK. One of the criticisms of the present climate change adaptation policy is that its focus is limited to adaptation

preparedness only (risk assessment), (Desai et al., 2012). This is further supported by the report revealing that present risk assessment processes in the UK mostly target emergency preparedness and planning only, rather than using this risk assessment to reduce risks and vulnerabilities at local levels (UNISDR EC OECD, 2013). Another major criticism is that the projections offer a false sense of certainty in adaptation planning and decision-making (Frigg et al., 2015; Tang and Dessai, 2012). Tang and Dessai (2012) criticise the usage of Baysian probabilistic projections in climate risk assessment since it reduces the saliency of decision-making. This may affect the effectiveness of climate adaptation planning.

Similarly, there are some knowledge gaps in climate change estimations although they are based on numbers and climate change figures. These knowledge gaps include the impact of snow cover and snowpack melting on river flows which are not taken into consideration by the scientific community. This may create issues for proper adaptation measures (Wilby et al., 2008). In addition, all of the 15 experts who participated in the study stated that risk assessments are done by both CCA and DRR communities for the same disaster in two different ways which has duplicated work with less efficiency.

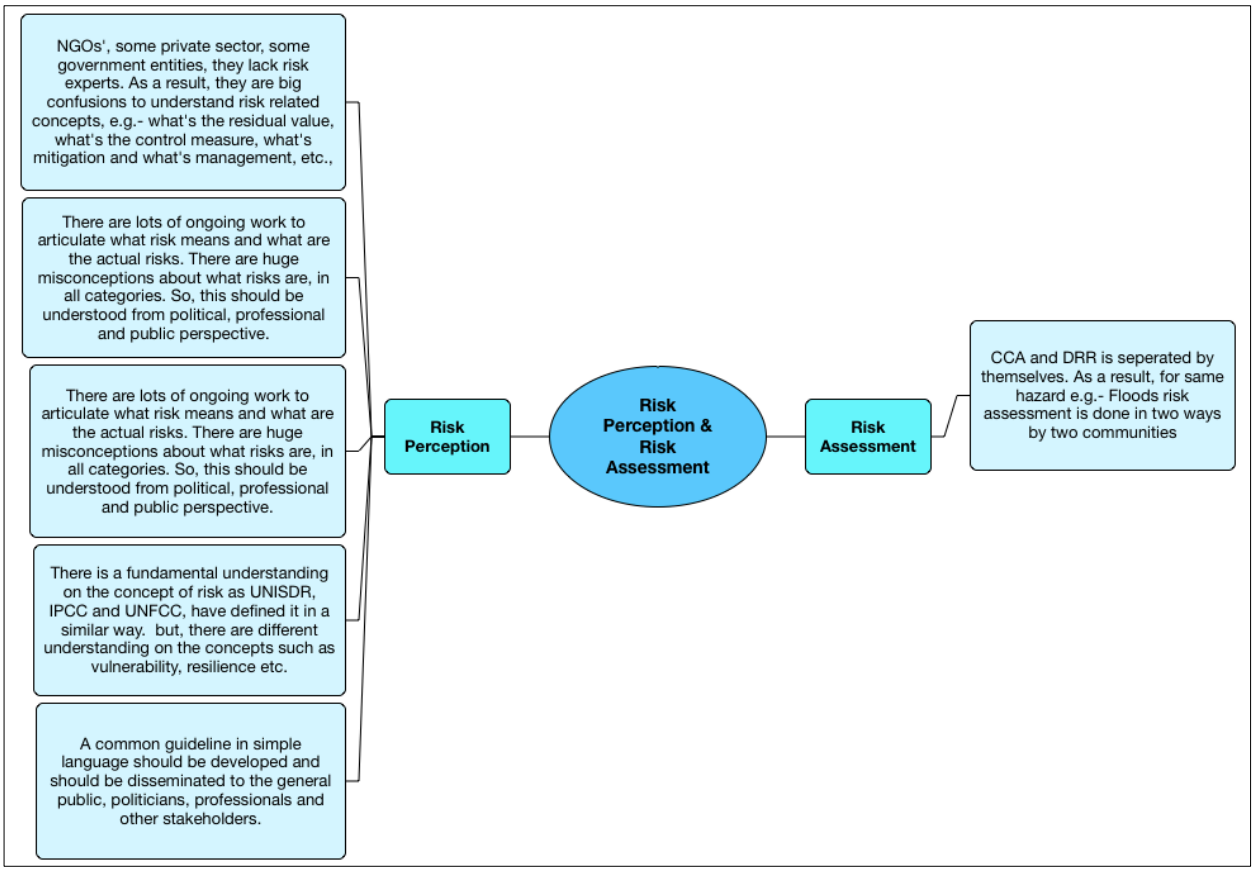

Figure 14-Risk Perception and Risk Assessment

4.3 Challenges/Gaps related to SCIENTIFIC FRAMEWORKS in the existing Science Approaches

UK Climate Change Risk Assessment (CCRA) has been identified as a system that uses scientific assessments to optimize climate change adaptation decisions (Porter et al., 2014; Tangney, 2016). The UK Government claims that their risk assessments are independent and impartial in policy making (Defra, 2012). However, the UK's CCRA is questionable regarding its effectiveness as a device for information transfer or institutional learning. Furthermore, the UK's CCRA is only considered as a tactical instrument to get political support for various policy positions. This makes it difficult to provide a wider scope for institutional learning about the character and management of climate risks. Among these problems, the method used to risk assess is inadequate for explaining climatic problems and does not provide any instrumental use of climate science. This also reduces the opportunity for learning about policy

making. The UK's risk assessment is based on the linear-rationalist method which assumes that climate adaptation problems are tractable, and can be defined correctly to facilitate good practice in decision-making, generating robust decisions with the best information available (Tangney, 2016).

Compared to other countries, the UK engages in significant levels of climate change research, nevertheless, policy making is influenced by cultural preferences (Jasanoff, 2011, cited in Lorenz et al., 2015). Furthermore, the policy making process does not consider climate change, model predictions and uncertainties within the UK NAS (Lorenz et al., 2015). For example, when compared to other EU countries, the UK NAS has included only future society, GHG emission and climate model as the identified uncertainties in their NAS. As a result, there are qualitative indicators for sources of information, climate scenarios and climate models for the UK's NAS when compared to Germany. There are no specific details on climate scenarios in the UK's NAS (Lorenz et al., 2015). Furthermore, some severe floods in the UK were generally supported by the thermodynamic arguments without explanation through the complex, hydro meteorological scientific base (Pall et al., 2011).

Most climate modelling depends on simulations. There may be conflicts, even among different scientists whose disciplines use different methods. This may affect the credibility of scientific conclusions (Pidgeon and Fischhoff, 2011).

4.4 Challenges/Gaps related to COMMUNICATION in the existing Legal/Policy Aspects

In the UK, both the media and internet are used as a communication strategy to make people aware of DRR. However, there is no record of introducing DRR knowledge in the school curriculum in the UK (UNISDR EC OECD, 2013). As highlighted by the UNISDR EC OECD (2013), there are many ways communication strategies hinder the CCA, DRR and their integration efforts in the UK. For example, there is no systematic data base for disaster losses and damages in the UK; there are issues in understanding early warning messages by different responders due to organizational differences (created as a result of administrative borders) between stakeholders (for example, the Met Office and Environment Agency); the preparedness strategies are communicated via only online systems which are not accessed by many people. Whilst the UK has developed a number of good mechanisms and practices for information sharing and risk communication, due to the sensitivity of the information, it is not accessible to all businesses or science communities (UNISDR EC OECD, 2013). Further, another major problem faced by the climate scientists is communicating their scientific findings to the non-scientific community for example, the general public and policy makers (Pidgeon and Fischhoff, 2011).

In addition to the literature synthesis, data analysis further highlighted the key issues in communication and information management and those can be discussed under four key areas, namely:

- Communication between CCA and DRR communities
- Communication between academic community and practitioners
- Communication between practitioners and the general public
- Communication with the adjoining nation states on trans-boundary crisis management

4.4.1.1 Communication between CCA and DRR Communities

Proper communication between CCA and DRR communities is essential in order to integrate CCA and DRR as well as to bridge the gap between science and legal/policies. Generally, CCA develops scientific data whereas DRR produces data based on community perceptions. Accordingly, these scientific data generated from CCA should be transferred to the policy level via DRR to the community level. Accordingly, it is essential to have a proper communication channel between CCA and DRR.

However, as the analysis highlights, currently, the CCA terminology is fairly separate. It is more technical or scientific and cannot be translated into simple English. As a result, it cannot be communicated at the community level of DRR. Further, it is noted that CCA and DRR collect two sets of data by their nature, e.g. the CCA community collects weather data and how those data can be converted to identify potential flood risks and so forth, whereas the DRR community, looks on the number of houses affected or at risk. However, the issue is not collecting different types of data, but rather, the CCA terminology is too technical and it cannot be translated to the community which DRR deal with.

Even though this is the current context, the key issue is that there is no proper or straightforward communication between CCA and DRR communities unless there are particular partnerships that have grown up informally between different entities. Whilst both disciplines do the same thing which is reducing the vulnerability of society, it is not viewed in that way by the two different communities.

Nevertheless, it is clearly identified that there is no statutory demand for information sharing between CCA and DRR communities. The figure below summarises the findings:

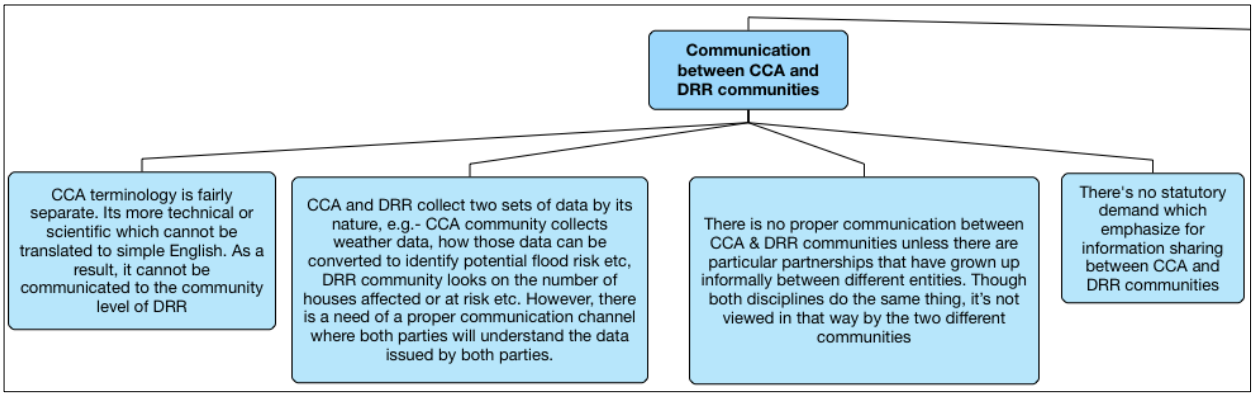

Figure 15-Communication between CCA and DRR communities

4.4.1.2 Communication between the Academic Community and Practitioners

Communication between the academic community and practitioners is important in order to transfer knowledge to the practitioners which has been gained from the scientific research conducted by the academics. This is not one-way communication, where the academic community also needs to adapt the latest tools and concepts in practice in order to improve their research as well as to improve the teaching quality. Generally, the analysis results highlight that there is proper communication between these two parties. It was highlighted that many UK universities have collaborations with national level organisations which deal with CCA and DRR. Further, there are non-government institutions who are active in DRR, sponsoring PhD students in order to keep the link and proper communication between these two parties, for example, Rescue Global. In addition, the Environment Agency has a strong link and collaborations with many leading universities in the UK. It was discovered that there is no legal/policy mandate which specifies or directs the communication between the academic community and the practitioners, but, as described, it is already there in a positive way. The figure below summarises the findings:

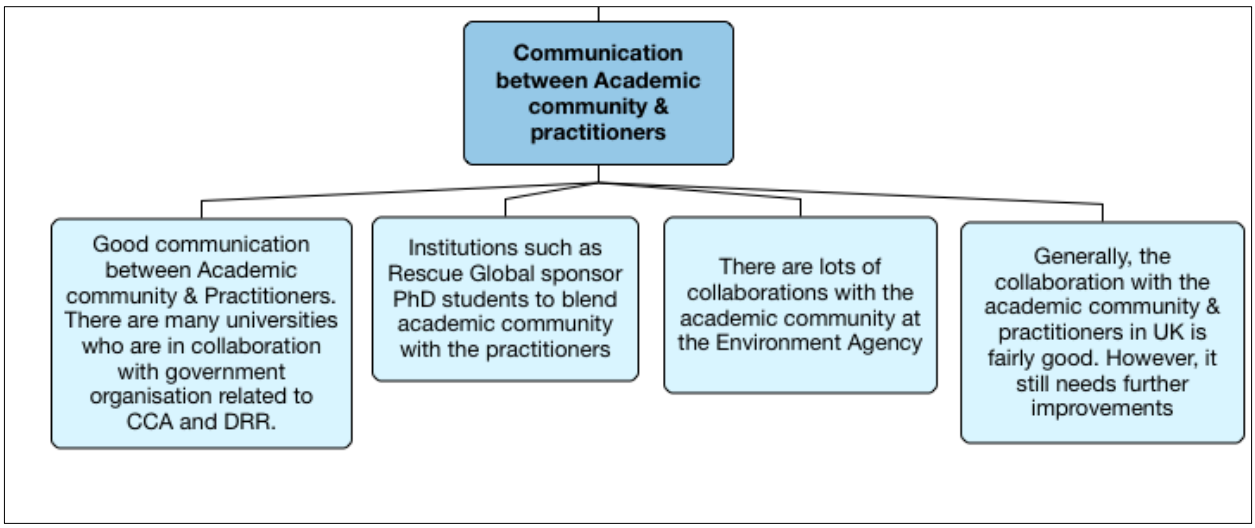

Figure 16-Communication between the academic community and practitioners

4.4.1.3 Communication between Practitioners and the General Public

Communication between practitioners and the general public is important in order to bridge the gap between science and legal/policies. Generally, once new knowledge is generated through science, it should be disseminated via practitioners into practice and that knowledge should be transferred to the general public. As the analysis highlights, the UK has achieved good progress on this.

The Environment Agency, which is one of the main bodies in the UK for disaster management, has done a great deal of work to communicate data to the general public. Basically, they are happy to disseminate specific data on disaster risks online which people can easily access. In addition, the Environment Agency holds different types of workshops and programmes to disseminate their findings to the general public. Further, most of the government institutions are very positive on communication of information to the general public. The Met Office, British Geological Survey Department, Environment Agency always seek to improve public communication.

The Civil Contingencies Act, 2004, makes provision to inform and warn the public of any potential disaster risk and therefore, there is good communication on potential disaster risks as it is a statutory requirement. However, there are two major issues in the communication flow between the practitioners and the general public. The first issue is the public interest. Even though the government organisations communicate to the community, people are reluctant to appreciate them as they have the perception that a disaster is unlikely to happen to them. According to one of the DRR practitioners who participated in the study:

"People think a disaster may not ever happen to them. They are very keen when a disaster happens somewhere in the country, but, refuse to understand that all communities have a risk of a potential disaster. So, until it happens they do not want to be updated about the disaster risks and its consequences."

Accordingly, in the UK, there is a need to integrate DRR and CCA into the school education system to increase awareness as well as to change perceptions in the long run.

Another key issue is the reporting of false information to the general public. People in the UK are highly active on social networks and there are several groups who report false information on social media. As a result of this, people have lost trust in reliable information which is released online, even by the relevant bodies. Accordingly, there is a need to clamp down on incorrect media reporting. Figure 16 summarises the findings:

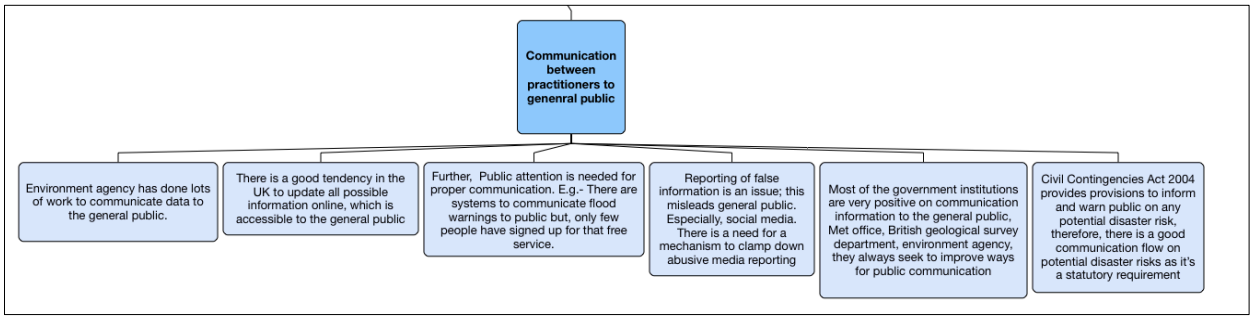

Figure 17-Communication, general public and the practitioners

4.4.1.4 Communication with the adjoining Nation States on trans-boundary Crisis Management

Generally, the UK is more independent when it comes to disaster management and does not have a strong communication link with the nation states on trans-boundary crisis management. 10 out of 15 experts emphasised that currently, in the UK, there is no political willingness to communicate with the nation states on trans-boundary crisis. 3 out of the other 5 experts in the study did not give any specific answer to this issue. However, 2 experts mentioned that there are many informal partnerships between the nation states but not any formal agreements. Accordingly, it can be noted the country is more independent and does not have much involvement in this issue. Reference to Section 4.1.5 on procedural gaps and legal frameworks emphasises the current status of this particular issue.

5 Conclusions & Recommendations

The United Kingdom has a strong legal/policy background in regard to CCA and DRR. However, the key issue is fragmentation. Due to this fragmentation of policies and the legal background, CCA and DRR are in separate departments and ministries. They operate in a totally isolated manner. Since there is a strong scientific background for CCA, there is huge political motivation for CCA rather than DRR. As a result, funding is attracted by CCA organisations which leaves little allocation for DRR activities. Since, CCA innovations are more science oriented, that knowledge needs to be transferred to the local level which should be done via DRR, the basis for community and local level interventions. However, since DRR attracts little political will and low levels of funding, the DRR community is not in a strong position to transfer this knowledge to the community level. As a result of this overall context, communication between CCA and DRR communities is poor which has led to competition between them rather than collaboration.

The UK's practice is to be more independent, thus, there is less room and interest for trans-boundary crisis management. There is no legal/policy in the UK to engage in trans-boundary crisis management. However, the UK has a strong communication network between the academic community and the practitioners which has helped to transfer scientific knowledge into practice and thence to the legal/policy platforms. Further, the UK is keen to transfer knowledge on disaster management to the general public, therefore, most of the information is freely available. At the same time, it was highlighted that the enthusiasm of the public should be further encouraged in order to effectively disseminate knowledge.

In order to overcome these issues, the current legal/policy and scientific backgrounds should be altered according to need. Therefore, during the next phase of this study, which is known as task 2.2 in the ESPREssO project, there will be a detailed review to find out how to overcome these issues by enhancing the current legal/policy and scientific backgrounds.

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